*** ABSTRACT ONLY ***

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Quantifying the Performance of Fire Detection, Sprinklers, and Fire Resistant Construction in the United States

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ABSTRACT

Under the Fire Administration Authorization Act of 1992 (PL 102-522, the National Institute of Standards and Technology (NIST) Building and Fire Research Laboratory (BFRL) was directed to conduct a study of the use, alone and in combination, of fire detection systems, fire suppression systems and compartmentation as predominant fire protection strategies for life safety and property protection. The objectives of this study were twofold. First, to quantify the performance and reliability of detection systems, suppression systems, and compartmentation including the field assessment of performance. And second, to determine the effect of the reduction or elimination of one or more of these on fire losses.

The first task included determining the potential capability of each of the fire protection alternatives. In order to assess the effectiveness in buildings, the impact of the individual and combined alternatives were evaluated both with and without accounting explicitly for the system's reliability. Estimates of the reliability of systems was based on data in the open literature and was compared to reliability estimates recently developed in the United Kingdom through a Delphi process. The potential impact of the systems in each of three occupancies was evaluated primarily based on analysis of NFIRS fire incident data but was supplemented by specific analyses using predictive methods to estimate the role of these fire safety alternatives under common fire scenarios.

The relative performance of each of the alternatives was determined in terms of potential property loss and casualty reductions in residential, commercial, and institutional occupancies. The analyses provided two, independent methods of comparing the level of property and life safety protection provided by the alternatives. Each of the methods had limitations. Combined, the analyses provide guidance in determining a relative ranking of the fire safety alternatives for the different occupancy groups, and the effect of reliability on these rankings.

Several significant results were consistent for both methods. These include:

(1) The addition of any protection reduces loss of life and property. Combinations of protection methods are always better than single approaches.
(2) Except for industrial property, smoke detection or automatic suppression provide greater loss reduction than does improved construction.
(3) For residential properties smoke detection and automatic suppression are better than any combination with fire rated construction.
(4) For commercial and residential property, all three methods together provide a measurable reduction in loss over other combinations.
(5) The general trend (but not always) is that smoke detection improves life safety while suppression and fire resistant construction decreases property loss.